

ABSTRACT

High-efficiency laser-like emission at low thresholds in dipolar organic materials upon pulsed optical excitation, without using any external mirrors. Unusually high conversion efficiencies and low thresholds in laser-like emission have been observed in the solutions of organic molecular salts having large dipole moments and specific dye molecules having high photoluminescence efficiencies. Pumped with frequency-doubled pulses from a Nd:YAG laser, conversion efficiencies in the range of 15 - 40% were achieved without incorporation of external mirrors. The threshold pump energies for such emission have been observed to be low ($<8\mu\text{J}$). The spectrally narrowed output beam was found to have low divergence, high degree of polarization, and pulse-width less than that of the excitation pulses (50 picoseconds). The exceptionally low threshold ($<1\ \mu\text{J}$) and high energy conversion efficiencies observed in molecular salts have been attributed to the large excited-state dipole moment of these noncentrosymmetric molecules favoring strong cooperative (laser-like) emission in spite of small photoluminescence quantum efficiencies.